Umbilical cord PH in pregnancies with and without meconium stained amniotic fluid

Azin Alavi[1], Mandana Saadat[1], Azadeh Rahmatian*[2], Farzaneh Sharifi[2], Zeinab Piraloo[3], Seyede Saeideh Namazi[4]

[1]. Hormozgan Fertility & Infertility Research Center, Hormozgan University of Medical Sciences (HUMS), Iran
[2]. Student Research Committee, Hormozgan University of Medical Sciences (HUMS), Bandar Abbas, Iran
[3]. Shiraz University of Medical Sciences (SUMS), Shiraz, Iran.
[4]. Islamic Azad University, Yasuj, Iran
Journal.hums@gmail.com

Abstract Meconium stained amniotic fluid (MSF) is a leading cause of neonatal mortality and morbidity. The aim of this study was to assess the association of umbilical cord vessels' PH with pregnancies complicated by meconium stained amniotic fluid. This cross sectional study was conducted among 195 pregnant women. The umbilical cord blood samples of 96 neonates (52 neonates with normal vaginal delivery (NVD) and 44 with cesarean section (C/S)) with MSF and of 99 neonates (49 neonates with NVD and 50 with C/S) with clear amniotic fluid were collected. DemograpHic data (age, gestational age), antenatal characteristics (duration of labor, active pHase and second stage of labor, duration of induction, type of anesthesia), postnatal characteristics (Apgar score at 1 and 5 min) was documented for each patient. Women with preterm labor or other pregnancy related diseases (hypertension, preeclampsia, gestational diabetes mellitus, prolonged rupture of membrane) and multifetus pregnancies were excluded. Data was analyzed using SPSS (V.18) by statistical tests (independent T-test, chi – square, ANOVA). P-value below 0.05 considered statistically significant. The mean age of participants was 26.8 ± 5.4. The mean PH value in all participants was 7.26± 0.07. There was no significant difference between the two groups (case and control) for PH ($p > 0.05$). The results showed that, duration of active pHase of labor, Apgar score at 1 min and the number of pregnancies had significant correlation with umbilical cord PH ($P < 0.05$). There was no significant relation between umbilical cord PH and duration of labor and second stage of labor, meconium concentration, type of anesthesia, duration of induction ($p > 0.05$). The mean umbilical cord PH among patients with meconium stained amniotic fluid was higher in neonates born thorough cesarean section. Apgar score at 1 min was related to umbilical cord PH.

[Alavi A, Saadat M, Rahmatian A, Sharifi F, Piraloo Z, Namazi SS. Umbilical cord PH in pregnancies with and without meconium stained amniotic fluid. Life Sci J 2013;10(8s):1-5]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 1

Keywords: Pregnancy, Amniotic Fluid, Umbilical Cord. Acid-Base Imbalance

1. Introduction

Meconium stained amniotic fluid (MSF) is a leading cause of mortality and morbidity of neonates after delivery. Also, it is a diagnostic sign in pregnancies demonstrates the maturity of fetal intestinal tract. The prevalence of MSF was reported between 7 to 22 % of pregnancies, up to 42 weeks of gestation (Balchin, Whittaker et al. 2011, Lee, Mi lee et al. 2011, Gun Eryilmaz, Tavil et al. 2012).

The incidence of meconium passage increases with gestational age and it is estimated that 30% of post-term pregnancies are complicated with MSF (Ahanya, Lakshmanan et al. 2005). This pHysiologic pHenomenon can lead to several complications such as meconium aspiration syndrome (MAS), fetal heart rate abnormalities and brain damage induced by hypoxia during intrauterine period and delivery (Kumar, Gupta et al. 2012, Narlı, Kırımi et al. 2013).

After delivery, it can lead to lower APGAR score (Oddie 2010). It is estimated that about half of the patients with MSF, develop MAS (Hiremath and Gane 2012). several studies have demonstrated that the risk of MAS increases with decreasing PH level of umbilical cord vessels (Roett, Lawrence et al. 2010, van Ierland, de Boer et al. 2010) . Nevertheless, some other studies have shown that, there is no relationship between the risk of MAS and acid – base status of umbilical cord (Fischer, Rybakowski et al. 2011).

The assessment of acid – base status of umbilical cord vessels, is an objective, noninvasive diagnostic method for evaluation of fetal hypoxia, early uteroplacental insufficiency in hospital, consequently results in therapeutic interventions and prevent more complications such as respiratory distress and ischemic – hypoxic encepHalopathy of neonates (De Paco, Florido et al. 2011). Maternal complications containing recurrent urinary tract infections, chorioamnionitis and postpartum

infections are higher in women with MSF than in those without MSF(Markovitch, Mazor et al. 1993).

Treatment strategies include amnioinfusion to dilute amniotic fluid(Siri 2010). Because of maternal and fetal complications of MSF, it is necessary to pay special attention and care for the patients with this problem. Accordingly, we aimed to assess the association of umbilical cord vessels' PH with pregnancies complicated with meconium stained amniotic fluid.

2. Material and Methods

This cross sectional study was carried out in 2011-2012 among the pregnant women attended to Shariati Hospital in Bandar Abbas, southern Iran.

A number of 195 pregnant women with term, singleton cepHalic presentation and 37 – 42 weeks of gestation were recruited in the study. The study was approved by ethical committee of Shariati Hospital and written informed consent was obtained from the participants. Random alignment was considered for age and gestational age. The umbilical cord blood samples of 96 neonates (52 neonates with normal vaginal delivery (NVD) and 44 with cesarean section (C/S)) with MSF and 99 neonates (49 neonates with NVD and 50 with C/S) with clear amniotic fluid were collected. The umbilical cord was double clamped just after delivery and a segment of 10-20 cm of umbilical cord was excised. The umbilical cord blood samples were poured into heparinised syringes and placed on ice dishes and transported to laboratory for assessing the blood gas status of samples.

Other information such as meconium concentration (thick or thin), gestational age, duration of induction, the length of rupture of membrane (ROM), mode of delivery, duration of delivery were collected for all patients. The Apgar scores were calculated for all neonates at 1 and 5 minutes of age. Duration of active pHase of labor and the mode of anesthesia (general or spinal) were documented for patients with NVD and C/S, respectively.

In this study patients with underlying disease or history of gestational diabetes mellitus, gestational hypertension, multifetal pregnancies, breech presentation, and placenta previa and placenta abruption were excluded. Data analysis was performed by SPSS (V.19) using descriptive statistics such as frequency, mean and standard deviation and statistical tests such as independent T-test, chi square and Pearson correlation. P –value < 0.05 was considered as statistically significant.

3. Results

Among the participants, the mean age was 26.8 ± 5.4 years. The mean gestational age at delivery was 39.1 ± 1.1 weeks and the mean birth weight was 3155.6 ± 393.3 g.

As table 1 shows, the mean age of gestation and duration of rupture of membrane (ROM) were significantly different among patients with MSF and those with clear amniotic fluid.

Table 1: demograpHic and antenatal characteristics of population with MSF and without MSF

variable	Case	Control	P - value
Maternal age (y, mean ± SD[+])	26.7 ± 5.6	26.9 ± 5.1	NS*
Gravida (median and range)	2 (1-8)	2 (1-8)	NS
Gestational age (wk, mean and range)	39.6 ± 1.1	38.5 ± 1	< 0.001
Duration of induction (min, mean ± SD)	18.94 ± 57.1	3.14 ± 2.24	NS
Duration of active pHase (min, mean ± SD)	67.34 ± 48	89.76 ± 67.06	NS
Duration of ROM (min, mean ± SD)	126.72 ± 172.15	205.39 ± 231.46	0.023

* : Not significant

\+ : standard deviation

The mean umbilical cord arterial and venous PH was 7.26 ± 0.07. The mean value of PH in patients with MSF was 7.27 ± 0.07 and among patients with clear amniotic fluid was 7.26 ± 0.08. There was no significant difference in PH between the patients with and without MSF (P – value = 0.35). The umbilical cord PH, had significant negative correlation with the duration of active pHase of labor (P < 0.001).

In this study, 8 neonates needed to ambo mask and oxygen after delivery; 6 were in MSF group and 2 were in group with clear amniotic fluid. There was no evidence of respiratory distress syndrome, and no one needed ventilator therapy. Also, there was no evidence of intracranial hemorrhage or other brain damage among the neonates.

In table 2, characteristics of neonates with and without MSF after delivery are listed with details

Table 2: characteristics of neonates with and without MSF after delivery

Variable	Case	Control	
Birth weight	3177.94 ±	3133.8 ±	NS

(g, mean and SD)	428	356.8	
Apgar score (median and range) At 1 min At 5 min	 9 (6-9) 10 (8-10)	 9 (6-10) 10 (9-10)	 0.024 NS
Umbilical cord PH	7.27 ± 0.07	7.26 ± 0.08	NS

Among 96 patients with MSF, 73 (76%) had thick meconium and 23 (24%) had thin meconium. The mean value of umbilical cord PH was not significantly different among the patients with thick meconium (7.26 ± 0.001) and those with thin meconium (7.28 ± 0.01) (P – value = 0.2).

The mean PH of umbilical cord in neonates born with NVD was 7.24 ± 0.09 and among those who were born with C/S was 7.28 ± 0.05. This difference was statistically significant (P = 0.001).

Among the neonates were born by C/S, the mean of umbilical cord PH in patients with MSF was 7.27 ± 0.06 and in patients with clear amniotic fluid was 7.29 ± 0.04. There was no significant difference between these groups (P = 0.2).

Among the neonates born through NVD, the mean of umbilical cord PH in patients with MSF 7.26 ± 0.07 and among those without MSF was 7.22 ± 0.1. There was no significant difference between these groups (P = 0.52).

Among the women who underwent C/S, spinal anesthesia was performed for 91 patients and general anesthesia was done for 5 patients. The mean umbilical PH among patients who underwent spinal and general anesthesia was 7.28 ± 0.05 and 7.29 ± 0.05, respectively. The difference of umbilical PH was not statistically significant between groups with spinal and general anesthesia (P = 0.7).

In this study, the mean umbilical cord PH among neonates who were born from multiparous mothers was significantly higher than nuliparous mothers (P = 0.007). In the following table, the association of umbilical cord PH with number of pregnancy is shown.

In this study, only one delivery was vacuum assisted, in which, umbilical cord PH was 7.07, Apgar scores at 1 and 5 min were 9 and 10 respectively.

4. Discussions

This study was conducted to assess the PH of umbilical cord vessels in pregnancies complicated with meconium stained amniotic fluid. Umbilical artery blood sampling, demonstrates the function of fetoplacental circulation and predict the metabolic status of neonates, while, umbilical vein blood sampling shows the placetnofetal blood flow and predict the maternal metabolic status (Vandenbussche, Oepkes et al. 1999). Thus, considering arterial and venous sampling can predict the metabolic status of both neonate and mother.

Table 3: association of umbilical cord PH with number of pregnancy

Gravid	Number	Mean (SD)	P - value
1	55	7.22 ± 0.08	0.007
2	66	7.28 ± 0.06	
3	33	7.27 ± 0.08	
4	19	7.28 ± 0.07	
5	1	7.23	
6	5	7.32 ± 0.04	
7	2	7.19 ± 0.07	
8	2	7.31 ± 0.07	
total	183	7.26 ± 0.07	

In this study, the mean birth weight was 3155.6 ± 393.3 g. this finding is higher than other studies conducted in India (Agarwal, Agarwal et al. 1991), Saudi Arabia (Zakzouk 1997) and Egypt (Dhar, Mowlah et al. 2011). This could be due to, better sanitary systems in Iran compared to other countries in western Asia.

As our results showed, gestational age among case groups was higher than the control group. It could be due to a pHysiologic process in which, increasing gestational age leads to fetal intestine maturation, consequently meconium passage will happen. It also could be due to increasing uterine activity with increasing gestational age. A finding reported by Bakker and colleagues (Bakker, Kurver et al. 2007).

The results of our study showed that, Apgar score at 1 min was higher among case group in comparison to control group. While, in a study conducted by Gun Eryilmaz, they concluded that, Apgar score at 1 min was not significatly diffetent among case and control groups (Eryilmaz, Aksakal et al. 2012). Several authors demonsteated umbilical cord PH depends various facotrs such as elective cesarean section, parity of mothers, spinal anesthesia during operation and uterine contraction during the second stage of labor (by impairment in placental flow) (Leung, Lok et al. 2004, Banerjee, Stocche et al. 2010).

Our results showed neonates who were born with C/S had higher umblical cord PH. This finding was consisted with other studies performed by Pence and colleaugues (S, H et al. 2002).

In this study we found that there was no statistically significant differnece between patients

underwent general and spinal anesthesia. While, jain and colleuges demonstrated patients with spinal anesthesia had lower umbililcal cord PH in comapred with general anesthesia (Jain, Bhardwaj et al. 2013). It is notable that, in our study umbilical cord PH value for patients with spinal anesthesia was higher than general anesthesia. Also, in our study only 5 patients underwent general anesthesia, and the patient number in this group was too small to be conclusive.

Our results showed meconium passage and induction had no significant association with umbilical cord PH. on the other hand, duration of active pHase had significant associations with cord blood PH. Therefore patients induction during active pHase may be beneficial in pregnancies with meconium stained amniotic fluid.

We enrolled all of the patients with cesarean either elective or emergency in our study, the neonates who classified in emergency may affect the final results of our study, tehrefore we recommend further studies with considering elective and emergency deliveries with sufficient sample size for both groups. Also, we suggest to consider general and spinal anesthesia as a separate variable with suffiecient population size.

Acknowledgements:

This study was designed based on student thesis. We sincerely thank all of the residents and nurses for active assistance in data collection. We would also like to acknowledge all the patients who cooperated in this study.

Corresponding Author:
Azadeh Rahmatian
Student Research Committee, Hormozgan University of Medical Sciences (HUMS), Bandar Abbas, Iran.
E-mail: journal.hums@gmail.com
Tel: +98.9364300246

References

1- Gun Eryilmaz, O., B. Tavil, S. Turan, O. Yumusak, M. Doganay, O. Uzunlar, S. Akar and E. G. Eyi (2012). "Hepcidin and erythropoietin measurements in the cord blood of neonates with meconium- stained amniotic fluid." Journal of Obstetrics and Gynaecology Research.
2- Balchin, I., J. C. Whittaker, R. F. Lamont and P. J. Steer (2011). "Maternal and fetal characteristics associated with meconium-stained amniotic fluid." Obstetrics & Gynecology 117(4): 828-835.
3- Lee, K. A., S. Mi lee, H. Jin Yang, C.-W. Park, S. Mazaki-Tovi, B. Hyun Yoon and R. Romero ."The frequency of meconium-stained amniotic fluid increases as a function of the duration of labor." Journal of Maternal-Fetal and Neonatal Medicine, (2011). 24(7): 880-885.
4- Ahanya, S. N., J. Lakshmanan, B. L. Morgan and M. G. Ross (2005). "Meconium passage in utero: mechanisms, consequences, and management." Obstetrical & gynecological survey 60(1): 45.
5- Narlı, N., E. Kırımi, M. Satar, M. Türkmen, M. Halaza and H. Yapıcıoğlu (2013). "Evaluation and Management of Neonates with meconium stained Amniotic Fluid." Eastern Journal of medicine 6(1): 18-21.
6- Kumar, S., S. Gupta, I. Mahato, R. Giri, A. Yadav, A. Thakur and K. Thapa (2012). "Maternal and fetal outcome in term labour with meconium stained amniotic fluid." Health Renaissance 10(3): 198-202.
7- Oddie, S. J. (2010). "Perspective on meconium staining of the amniotic fluid." Archives of Disease in Childhood-Fetal and Neonatal Edition 95(1): F7-F8.
8- Hiremath, P. and B. Gane (2012). "Management practices and outcome of meconium stained amniotic fluid."
9- Roett, M. A., D. Lawrence and K. Bennett (2010). "Meconium aspiration syndrome."
10- van Ierland, Y., M. de Boer and A. J. de Beaufort (2010). "Meconium-stained amniotic fluid: discharge vigorous newborns." Archives of Disease in Childhood-Fetal and Neonatal Edition 95(1): F69-F71.
11- Fischer, C., C. Rybakowski, C. Ferdynus, P. Sagot and J. Gouyon (2011). "A Population-Based Study of Meconium Aspiration Syndrome in Neonates born between 37 and 43 weeks of gestation." International journal of pediatrics 2012.
12- De Paco, C., J. Florido, M. C. Garrido, S. Prados and L. Navarrete (2011). "Umbilical cord blood acid–base and gas analysis after early versus delayed cord clamping in neonates at term." Archives of gynecology and obstetrics 283(5): 1011-1014.
13- Markovitch, O., M. Mazor, I. Shoham- Vardi, W. Chaim, J. R. Leiberman and M. Glezerman (1993). "Meconium stained amniotic fluid is associated with maternal infectious morbidity in pre term delivery." Acta obstetricia et gynecologica Scandinavica 72(7): 538-542.
14- Siri, V. (2010). "Intrapartum Amnioinfusion In Labor With Thick Meconium Stained Liquor A Case Control Study."

15- Vandenbussche F, Oepkes D, Keirse M. The merit of routine cord blood pH measurement at birth. Journal of perinatal medicine. 1999;27(3):158-65.
16- Agarwal, K., D. Agarwal and K. Mishra (1991). "Impact of anaemia propHylaxis in pregnancy onmaternal haemoglobin, serum ferritin & birth weight." The Indian journal of medical research 94: 277.
17- Zakzouk, S. M. (1997). "Epidemiology and etiology of hearing impairment among infants and children in a developing country: Part II." Journal of otolaryngology 26(5): 335-344.
18- Dhar, B., G. Mowlah, S. Nahar and N. Islam (2011). "Birth-weight Status of Newborns and Its Relationship with Other Anthropometric Parameters in a Public Maternity Hospital in Dhaka, Bangladesh." Journal of Health, Population and Nutrition 20(1): 36-41.
19- Bakker, P., P. Kurver, D. Kuik and H. Van Geijn (2007). "Elevated uterine activity increases the risk of fetal acidosis at birth." American journal of obstetrics and gynecology 196(4): 313. e311-313. e316.
20- Eryilmaz, O. G., F. N. Aksakal, N. Cicek, E. G. Eyi and A. Avci (2012). "Ozlem Gun Eryilmaz, F. Nur Aksakal, Nedim Cicek, Elif Gul Eyi, Aslihan Avci." European Journal of Obstetrics & Gynecology and Reproductive Biology 161(1): 26-29.
21- Leung, T. Y., I. H. Lok, W. H. Tam, T. N. Leung and T. K. Lau (2004). "Deterioration in cord blood gas status during the second stage of labour is more rapid in the second twin than in the first twin." BJOG: An International Journal of Obstetrics & Gynaecology 111(6): 546-549.
22- Banerjee, A., R. M. Stocche, P. Angle and S. H. Halpern (2010). "Preload or coload for spinal anesthesia for elective Cesarean delivery: a meta-analysis." Canadian Journal of Anesthesia/Journal canadien d'anesthésie 57(1): 24-31.
23- S, P., K. H, B. O and B. A (2002). "the effect of delivery on umbilical arterial cord blood gasses and lipid peroxide:comparison of vaginal delivery and cesarean section." Clin Exp Obstet Gynecol 29(3): 212-214.
24- Jain, K., N. Bhardwaj, A. Sharma, J. Kaur and P. Kumar (2013). "A randomised comparison of the effects of low-dose spinal or general anaesthesia on umbilical cord blood gases during caesarean delivery of growth-restricted foetuses with impaired Doppler flow." European Journal of Anaesthesiology (EJA) 30(1): 9-15

4/2/2013